

W., had veered to westerly. On the morning of the 15th, the centre had moved eastward to 30° W; S. S. *Ohio* in 50° N., 25° W., reported barometer 29.88 or 758.0, S. by W. 5; S. S. *Strassburg*, 46° N. 37° W., 29.58 or 751.3, NW. 9, rain and hail showers, high seas, much water on deck; Bark *Syringa*, 46° N., 36° W., 29.80 or 756.9, WNW., fresh gale, constant showers and cross sea. On the morning of the 16th it was central about 20° W.; S. S. *Ohio*, 51° N., 17° W., reported barometer 29.25 or 743.0, SW. 5, while severe NW. to Wly gales and very high seas prevailed from 25 to 40° W.; S. S. *Strassburg*, 45° N., 40° W., barometer 29.65 or 753.1, W. to NW., 9 to 10. Area No. V passed rapidly eastward over Newfoundland on the morning of the 16th. By the morning of the 17th, the centre had passed eastward to 30° W. and by morning of the 18th to 20° W. Bark *Syringa* reported, 17th, 46° N., 29° W., 29.20 or 741.7, W. gale, frequent heavy showers, and S. S. *Britannic*, 18th, 51° N., 23° W., 28.87 or 733.3, NW. 6, squally. Area No. VI moved eastward, to the south of Nova Scotia and Newfoundland, during the 18th and by morning of the 19th was central to the southeast of the latter; S. S. *Strassburg*, in 43° N., 51° W., reported barometer 29.67 or 753.6, S. 2. By morning of the 20th, this area had moved rapidly northeastward and was followed over the western Atlantic by the area of high pressure described in *April Review* as area No. VII; the barometer on board the *Strassburg*, 43° N., 55° W., had risen to 30.23 or 767.8, with clear weather. On the 21st the area of low pressure passed northeastward between the British Isles and Iceland, and high pressures covered the ocean, west of the 30th meridian. Thence to the end of April the area of high pressures moved slowly northeastwards towards northwestern Europe, until on the 30th, the pressure over the British Isles reached 30.50 or 774.7. Areas of low barometer (Nos. XII and XIII of the *April Review*) moved eastward over Newfoundland on the morning of the 24th, and the afternoon of the 27th, respectively, but passed thence to the northeast without materially affecting the weather to the southward.

Chart No. V shows by isobaric and isothermal lines the mean pressure and temperature, and by small arrows the prevailing direction of the wind, at 7:35 a. m. Washington mean time, over the Northern and portions of the Southern Hemisphere for the month of *September*, 1878. The barometer observations have been corrected for temperature and reduced to sea level. At stations lying outside the area included within the lines, and for those in the Southern Hemisphere, the means are shown by figures indicating the temperature in degrees, Fahr., and the pressure in English inches. Upon comparing the distribution of atmospheric pressure for the present month (*September*, 1878,) with that for the preceding month (*August*, 1878,) the most marked changes are found to be a decided increase of pressure over the entire area included between the parallels of 30° and 60° N., and extending from 140° W. eastward over North America, the Atlantic Ocean, Europe and Asia, and a decided fall at all stations over the Atlantic Ocean to the north and south of those parallels. The increase of pressure referred to above amounts to about 0.10 inch over the small portion of the Pacific and over the eastern half of the Atlantic, from 0.10 to 0.20 over the eastern half of North America and western part of the Atlantic, about 0.15 over Europe, and from 0.20 to 0.35 over the interior of Asia. Over Hindostan, along the coast of China, and at Tokio, Japan, the increase is quite small, and at Chittagong and Nagasaki, near the southern, and at Nikolaievsk on the Amoor, near the northern margin of the zone of high pressure, a small decrease is perceptible. The most marked decrease of pressure over the Northern Hemisphere is found to the north of the British Isles, the area being bounded on the south by Sandwick, Vestervig and Stockholm, and on the east and west by Archangel and Godthaab, respectively. The decrease amounts to 0.33 inch at Stykkisholm, 0.26 at Thorshavn, 0.24 at Tromso, and 0.19 at Haparanda. The observations at all stations over the Atlantic south of 25° N., namely, Freetown, Sierra Leone, Porto Praya, Cape Verde Islands, Paramaribo, Guiana, and those in the West India Islands, show a decrease amounting to about 0.03 inch at the three former, and from 0.05 to 0.08 at the W. I. stations.

On chart No. VI are traced the paths of 24 of the principal storm-areas which traversed the northern hemisphere during the month of *September*, 1878. They fully represent the two great classes of storms experienced over the northern hemisphere, namely, those moving in an easterly path to the north of the 40th parallel, and those having the characteristics of tropical cyclones. Of the latter there are six, namely, Nos. II, X and XXI, to be found over the western portion of the Atlantic, and Nos. IV, XI and XV over the western Pacific. The tracks over the Behring Sea region are based upon reports from St. Michaels, (7 daily) St. Paul's Island, (3 daily) and Unalaska (3 daily); and those over Hudson's Bay and Greenland upon York Factory, Schr. Florence (in Northumberland Inlet,) Godthaab and Stykkisholm.

TEMPERATURE OF THE AIR.

The mean temperature of the air for the month of *May*, 1880, is shown by isotherms on chart No. II. Compared with the average mean temperature of the past eight years for the month of *May*, the means for the present month show a uniform excess ranging from 3° to 7° over the entire country east of the Rocky mountains, except in Florida, the Canadian Maritime Provinces, and North and Southeast Rocky Mountain slopes, and a decided deficiency over the Western Plateau districts and North Pacific coast regions. In California the mean for San Francisco is $1^{\circ}.1$ above normal, while those for Sacramento and San Diego are about normal. As will be seen on examining the table of comparative temperatures given on chart No. II, the excess is greatest in the Middle Atlantic States, where it amounts to $7^{\circ}.4$, and the deficiency greatest in the North Pacific coast region, where it is $3^{\circ}.8$.

The following notes regarding the unusual high temperatures of the month are of interest: St. Louis, 8th, heat intense, one sunstroke, fatal; monthly mean temperature 4° above the average for several years.

Baltimore, 27th, two cases of sunstroke, both fatal; 29th, a marked increase of the death rate during the past week of intense heat, 190 deaths against 91 of corresponding week in May of 1879; highest monthly mean temperature on record, 6° above mean of past 10 years. Riley, Ill., monthly mean temperature 7.2° above mean of 19 years. Logan, Iowa, warmest May ever known in this section. Reading, Pa., 27th, this section of the state has suffered with the intense heat, temperature 26th, 27th, 95° in the shade. At Birdsboro, Pa., 27th, temperature 98° in the shade; men in rolling mills compelled to stop work. At Douglasville, temperature 100° in shade. Colemansville, Lancaster county, one sunstroke, fatal. Hoken-doqua, 27th, four men died from the effects of over heat. In the coal regions there has been intense suffering, most of the men compelled to stop work. New York City, 28th, 14 cases of sunstroke, 12 of which were fatal. Boston, 28th, hottest period for many years, two horses killed by heat and two persons fatally injured. Gardiner, Me., monthly mean temperature 3.4° above the mean for 44 years. Sandy Springs, Md., monthly mean temperature 7° above the normal. Thornville, Mich., warmest May for many years. Palermo, N. Y., warmest May in past 23 years. Cleveland, monthly mean temperature 8.2° above mean for past 26 years.

Maximum Temperatures.—*Maine*: 94° at Portland and 79° at Eastport. *New Hampshire*: 96° at *Grafton and 62° on summit of Mt. Washington. *Vermont*: 95° at *Charlotte and 86° at *Lunenburg. *Massachusetts*: 97° at Boston and 94° at Springfield. *Rhode Island*: 84° at Newport. *Connecticut*: 92° at *Southington and 89° at *Mystic and New Haven. *New York*: 95° at *Troy, *Ardenia and *Port Jervis, 94° at New York City, 79° at Buffalo and 86° at Oswego. *New Jersey*: 101° at *New Lisbon, 98° at *New Brunswick and 89° at Atlantic City. *Pennsylvania*: 98° at *Egypt, 96° at Philadelphia and *Milton and 94° at Pittsburg. *Delaware*: 94° at *Dover. *Maryland*: 95° at *Woodstock and 93° at Baltimore. *District of Columbia*: 96° at Washington. *Virginia*: 98° at Norfolk and 97° at *Accotink. *West Virginia*: 88° at *Helvetia and 86° at Morgantown. *North Carolina*: 100° at *Weldon, 92° at Wilmington and 87° at *Franklin. *South Carolina*: 89° at Charleston. *Georgia*: 90° at *Forsyth and 89° at Savannah and Augusta. *Florida*: 96° at *Houston, 95° at Jacksonville, 90° at Key West and 88° at Pensacola. *Alabama*: 92° at Montgomery and 90° at Mobile. *Mississippi*: 93° at Vicksburg and 86° at *Fayette. *Louisiana*: 96° at Pt. Pleasant and 88° at New Orleans. *Texas*: 108° at *Ringgold, 104° at Eagle Pass and 100° at Stockton and Laredo. *Ohio*: 94° at *Ruggles, 88° at Cincinnati and 86° at Cleveland. *Kentucky*: 90° at *Bowling Green and Louisville. *Tennessee*: 91° at Mem his and 86° at *McMinnville. *Arkansas*: 91° at Little Rock and 80° at *Mt. Ida. *Michigan*: 91° at *Hudson, 90° at *Thornville and 83° at Grand Haven. *Indiana*: 93° at *Vevay and 85° at Indianapolis. *Illinois*: 92° at *Peoria, 88° at Cairo and 85° at Chicago. *Missouri*: 95° at *Pierce City and 89° at St. Louis. *Kansas*: 100° at *Fort Wallace and 90° at Leavenworth. *Wisconsin*: 90° at *Beloit and 87° at La Crosse. *Iowa*: 96° at *Boonsboro and 93° at Des Moines. *Nebraska*: 96° at *Howard and 94° at North Platte. *Indian Territory*: 97° at Fort Sill and 94° at Fort Gibson. *Minnesota*: 91° at St. Paul and 86° at Duluth. *Dakota*: 94° at Yankton, 92° Bismarck and 84° at Deadwood. *Colorado*: 89° at *Fort Collins and Denver, and 47° on the summit of Pike's Peak. *New Mexico*: 99° at La Mesilla and 80° at Santa Fe. *Wyoming*: 87° at *Fort Fetterman and 84° at Cheyenne. *Utah*: 87° at *Blue Creek, 80° at Salt Lake City and 75° at Coalville. *Nevada*: 90° at *Palisade and *Tecoma, 82° at Winnemucca. *Arizona*: 104° at Yuma and Tucson and 101° at Phoenix and Burkes. *Idaho*: 83° at Boise City and 75° at *Fort Hall. *Montana*: 97° at Fort Keogh and 70° at Virginia City. *California*: 108° at *Indio and *Davis, 97° at Los Angeles, 95° at Visalia, 92° at Red Bluff and 83° at San Francisco. *Oregon*: 90° at Umatilla and 81° at Roseburg. *Washington Territory*: 75° at Olympia.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—*Maine*: 34° at Eastport, *Gardiner and *Surry and 29° at *Orono. *New Hampshire*: 30° at *Dunbarton and —1° on Summit of Mt. Washington. *Vermont*: 27° at Burlington and 26° at *Newport. *Massachusetts*: 35° at Springfield, 33° at Boston and 25° at *South Lee. *Rhode Island*: 37° at Newport. *Connecticut*: 35° at *Southington and New London and 34° at New Haven. *New York*: 34° at New York city and Oswego, 30° at Buffalo and 23° at *Waterbury. *New Jersey*: 32° at *Freehold and *Atco and 30° at *Somerville. *Pennsylvania*: 28° at *Newcastle and 20° at *Franklin. *Delaware*: 40° at *Dover. *Maryland*: 38° at Baltimore and 33° at *Woodstock. *District of Columbia*: 38° at Washington. *Virginia*: 46° at Cape Henry and 32° at Mt. Solon. *West Virginia*: 36° at Morgantown and 30° at *Helvetia. *North Carolina*: 45° at Wilmington and 34° at Murphy. *South Carolina*: 53° at Charleston. *Georgia*: 50° at Augusta and 44° at Atlanta. *Florida*: 70° at Key West and 54° at *Houston. *Alabama*: 53° at Mobile and 49° at Montgomery. *Mississippi*: 56° at *Fayette and 52° at Vicksburg. *Louisiana*: 63° at *Pt. Pleasant and 54° at Shreveport. *Texas*: 40° at Davis and 34° at Mason. *Ohio*: 33° at Cleveland and *North Lewisburg and 28° at *Westerville. *Kentucky*: 52° at *Bowling Green and 43° at Louisville. *Tennessee*: 40° at Nashville and *Ashwood and 37° at Knoxville. *Arkansas*: 47° at Little Rock and 43° *Mt. Ida. *Michigan*: 29° at Port Huron, 28° at *Hudson and 27° at Alpena. *Indiana*: 40° at Indianapolis and 33° at *Spiceland. *Illinois*: 41° at *Riley and 37° at Chicago. *Missouri*: 44° at St. Louis and 40° at *Ashley. *Kansas*: 44° at Dodge City and 41° at *Cedar Vale. *Wisconsin*: 38° at *Beloit and 31° at *Ripon. *Iowa*: 44° at Dubuque and Des Moines and 37° at *Nora Springs. *Nebraska*: 37° at *De Soto and 29° at *Fort Hartsuff. *Indian Territory*: 52° at Fort Sill and 43° at Fort Gibson. *Minnesota*: 33° at Duluth and Breckenridge. *Dakota*: 31° at Pembina and 27° at Deadwood. *Colorado*: 24° at *Hermosa and 3° on summit of Pike's Peak. *New Mexico*: 28° at Fort Wingate and 24° at Santa Fe. *Wyoming*: 28° at Cheyenne and 23° at *Fort Fetterman. *Utah*: 32° at Salt

Lake City and 25° at *Coalville. *Nevada*: 24° at Winnemucca and 18° at *Otego. *Arizona*: 38° at Wickenburg, 29° at Apache and 27° at Prescott. *Idaho*: 34° at Boise City and 14° at *Fort Hall. *Montana*: 27° at *Helena and 23° at Virginia City. *California*: 40° at Red Bluff and Visalia, 39° at Sacramento, 32° at *Fehachapi, 24° at Campo and 18° at *Summit. *Oregon*: 35° at Portland and 33° at Roseburg. *Washington Territory*: 34° at Olympia.

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Ranges of Temperature at Signal Service Stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England from 21° at Wood's Holl and 37° at Springfield to 46° at Boston; Middle Atlantic States, 18° at Cape May to 35° at Lynchburg; South Atlantic States, 15° at Cape Lookout, 20° at Savannah to 30° at Wilmington; Eastern Gulf States, 16° at Key West and New Orleans to 26° at Montgomery; Western Gulf States, 15° at Galveston to 28° at Corsicana; Tennessee and the Ohio valley, 24° at Memphis to 34° at Pittsburg; Lower Lake region, 26° at Erie and Buffalo to 37° at Rochester; Upper Lake region, 27° at Grand Haven to 44° at Port Huron and 47° at Duluth and Marquette; Upper Mississippi valley, 27° at Davenport to 41° at St. Paul; Red River of the North valley, 44° at Pembina to 45° at Breckenridge; Missouri valley, 30° at Leavenworth to 43° at Yankton and 47° at North Platte; Texas, 28° at Decatur, Uvalde and San Antonio to 47° at Fort Elliott; Eastern Rocky Mountain slope, 39° at Fort Custer to 41° at Deakwood and 42° at Dodge City; Rocky Mountains, 23° on summit of Pikes Peak to 46° at Helena and Socorro to 49° at Denver; Middle Plateau, 34° at Boise City and Salt Lake City to 40° at Winnemucca; California, 23° at San Francisco to 34° at Red Bluff and 41° at Visalia.

Frost was reported from nearly every State and territory north of the 35th parallel. East of Mississippi it occurred on the following dates: 1st, 2nd, 7th, 8th, 13th, 14th, 15th, 16th, 19th, 21st and 29th, and west of the Mississippi on the 1st, 2nd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 20th, 21st, 24th, 25th, 27th and 31st. In many localities severe injury resulted to fruit and vegetables as follows: Fort Collins, Col., 9th, corn and garden crops seriously injured. Southington, Conn., 15th, tender vines blighted. Nile, N. Y., 15th early fruit severely injured. Weldon, N. C., 14th, potato vines injured. Westerville, Ohio, 1st, early fruit damaged. Jacksonburg and Ringgold, Ohio, 1st, fruit injured. Bloominggrove, Pa., 15th, fruit buds and blossoms injured. Litchfield, Pa., 15th, considerable damage to gardens. Windsor, Vt., 15th, early vegetables damaged. Charlatta, N. C., 1st, injuring potato vines. Yamhill County, Or., 11th, garden vegetables generally and wheat in some localities injured.

Ice formed as follows: Roseburg, Or., 13th; Salt Lake City, 6th; Winnemucca, Nev., 31st; Springfield, Mass., 1st; Eastport, 1st; Burlington, Vt., 1st, (15th, ice in Broad Lake $\frac{1}{2}$ inch thick for a distance of three miles off Essex); New Haven, Conn., 1st; Ft. Collins, Col., 7th, $\frac{1}{2}$ inch; Southington, Conn., 1st; Fallston, Md., 1st, $\frac{1}{2}$ inch; Somerset, Mass., 1st; Fall River, Mass., 1st; Freehold and Linden, N. J., 1st; Ardenia, N. Y., 1st; Waterburg, N. Y., 15th; Palermo, N. Y., 1st, $\frac{1}{2}$ inch; Nile, N. Y., 15th; Bellefontaine and Jacksonburg, Ohio, 1st, Norwalk, Ohio, 1st, three-tenths inch—14th, 15th, one-tenth inch; West Chester, Fallington and Milton, Pa., 1st; Litchfield, Pa., 1st, $\frac{1}{2}$ inch; Coalville, Utah, 15th, 25th; Charlottesville, Vt., 1st, ice along shore of lake.

Ground Frozen.—Rowe, Mass., and North Volney, N. Y., 1st, quite hard.

PRECIPITATION.

The general distribution of the rain-fall, including melted snow, for May 1880, is illustrated upon chart No. III, as accurately as possible from about 500 reports. In a small table on this chart will be found the average precipitation for the month of May, compared with the precipitation during the present month. Throughout the Atlantic States, except Florida, and in the Missouri valley, the rain-fall has been deficient and severe droughts have resulted in these sections. The heaviest rains have fallen in Alabama, Indiana, Michigan, Indian Territory and Texas; damaging floods occurred in Indiana and Georgia on the 21st and in Texas from the 27th to 29th, details of which will be found below.

Special Heavy Rains.—1st, New Ulm, Tex., 2.31 in.; San Antonio, Tex., 2.54 in.; Mason, Tex., 3.64 in. 3rd, Jacksonville, Fla., 2.17 in. Mayport, Fla., 2nd to 4th 5.53 in. 8th, Springfield, Ill., 2.66 in.; Peoria, Ill., 3.94 in.; Mt. Sterling, Ill., 3.20 in. 9th, Louisville, Ill., 2.70 in. 9th to 11th, Litchfield, Mich., 2.30 in. 8th to 10th, Ashley, Mo., 3.17 in. 9th and 10th, Logansport, Ind., 4.28 in. 10th, Niles, Mich., 2.80 in.; Wabash, Ind., 2.15 in. 10th to 11th, Coldwater, Mich., 2.75 in. 11th, Key West, Fla., 3.08 in. 11th to 13th, Gulf Hammock, Fla., 3.55 in. 14th, Ft. Wallace, Kan., 4.00 in. 17th to 18th, Pembina, Dak., 3.18 in. 19th to 21st, Litchfield, Mich., 4.25 in. 20th, Toledo, O., 1.10 in. in 15 minutes; Fort Sill, Ind. Ter., 2.76 in. 20th to 21st, St. Meinrad, Ind., 4.00 in.; Louisville, 1.95 in. 21st, Indianapolis, 2.69 in.; Montgomery, 3.33 in.; Wabash, Ind., 3.20 in.; Lansing, Mich., 2.73 in.; New Harmony, Ind., 3.33 in. 21st to 22nd, Elsworth, N. C., 5.50 in. in 22 hours. 22nd, Niles, Mich., 3.35 in.; Coldwater, Mich., 3.70 in.; Columbus, Ga., 9.92 in., 8.50 in. in 10 hours. 23rd, Elsworth, N. C., 2.75 in. 25th to 26th, Tabor, Ia., 2.11 in.; Manhattan, Kan., 2.81 in.; Breckenridge 4.05 in. 25th to 27th, Mobile, 3.41 in. 26th, Pensacola, Fla., 2.29 in.; Pembina, Dak., 2.64 in.; Ft. Barrancas, Tex., 4.23 in. 26th to 27th, New Orleans, 3.25 in. 27th, Austin, Tex., 3.00 in. 27th to 28th, Ft. Sill, Ind. Ter., 3.59 in.; Nashville, Tenn., 2.25 in. 28th to 29th, Pilot Point, Tex., 3.05 in.; St. Meinrad, Ind., 4.50 in.; Denison, Tex., 3.04 in. 23th, Boerne, Tex., 6.52 in.; Brackettsville, Tex., 12.43 in. 29th to 30th, Tabor, Ia., 3.03 in.; Des Moines, 2.91 in.; Cincinnati, 2.23 in. Louisville,